



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Date: April 11, 2007

SHANE ELWART, GOPICHANDRA SURNILLA and JOSEPH R. THEIS

Serial No. : 10/767,339

Group Art Unit: 1754

Filed : January 28, 2004

Examiner: Edward Johnson

For : SYSTEM AND METHOD FOR REMOVING HYDROGEN SULFIDE
FROM AN EMISSIONS STREAM

Mail Stop APPEAL BRIEF - PATENTS

Commissioner for Patents

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Angie C. Farr

Respectfully submitted,

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FGT3C7
81090700**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of

Date: May 16, 2007

SHANE ELWART, GOPICHANDRA SURNILLA and JOSEPH R. THEIS

Serial No. : 10/767,339

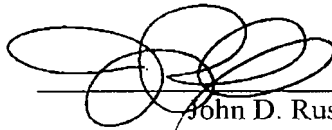
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For : SYSTEM AND METHOD FOR REMOVING HYDROGEN
SULFIDE FROM AN EMISSIONS STREAMMail Stop APPEAL BRIEF - PATENTS
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John D. Russell**RESPONSE**

In response to a telephonic Office communication on May 22, 2007, please consider the following:

Remarks : Begin on page 2

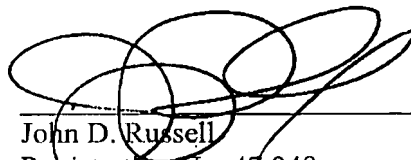
FGT3C7
81090700**Remarks:**

Attached is a second substitute "Section V" of the appeal brief as requested on May 22, 2007 via telephone. If still further changes are required please contact the undersigned as soon as possible.

Prior to entry of this response, claims 1-40 were pending claims under appeal in the application, with claims 41-46 having already been cancelled. Applicants respectfully request reconsideration of the application and allowance of the pending claims.

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V. SUMMARY OF CLAIMED SUBJECT MATTER

As described in Applicants' specification, various mechanisms have been developed to reduce NOx emissions in lean-burning engines. One mechanism is a catalyst known as a NOx trap. While the use of a NOx trap can substantially reduce NOx emissions from a lean-burning engine, NOx traps are also susceptible to poisoning from sulfur in fuels, thus degrading performance. Specification, page 1, line 11 to page 2, line 2.

Therefore, to reinstate performance, various methods of desulfating NOx traps may be used. These methods, while effective in removing SOx from the trap surfaces, can cause the production of hydrogen sulfide. Specifically, the inventors herein have recognized that variations in air-fuel ratio that may occur at certain stages of reactions can cause the production of hydrogen sulfide in different ways depending on exhaust temperature. Specification, page 2, lines 3-7.

Thus, one approach to solve this problem is set forth in claim 1, which claims:

A method of removing hydrogen sulfide from an emissions stream, comprising:

directing the emissions stream into a hydrogen sulfide converter having a metal oxide catalyst (Specification, page 6, line 20 to page 7, lines 20, Figure 2, for example);

adsorbing the hydrogen sulfide in the emissions stream to the metal oxide catalyst in the hydrogen sulfide converter (Specification, page 7, line 9 – page 8, line 8, page 11, line 12- page 12, line 19, for example);

reacting the hydrogen sulfide with at least one of an oxidant and a reductant in the hydrogen sulfide converter to chemically transform the hydrogen sulfide (Specification, page 7, line 9 – page 8, line 8, page 11, line 12- page 12, line 19, for example); and

adjusting an air-fuel ratio of the emissions stream based on exhaust temperature of an emission control device, where said adjustment varies a duration of at least one of lean and rich operation to perform said adsorbing and reacting even as exhaust temperature varies (Specification, page 17, line 1-21, Figure 8, block 616, for example).

Specifically, by adjusting the air-fuel ratio of the emissions stream based on exhaust temperature of an emission control device (where the adjustment varies a duration of at least one of lean and rich operation to perform the adsorbing and reacting even as exhaust temperature varies), it is possible to reduce the emission of hydrogen sulfide across a wider temperature range. Specification, page 2, lines 10-20.

Similar to Claim 1, Claim 16 sets forth the following:

16. (original) A method of desulfating a catalytic converter, comprising:
transforming sulfur in the catalytic converter to hydrogen sulfide (Specification, page 6, line 13 to page 7, line 2, for example);
transporting the hydrogen sulfide out of the catalytic converter (Specification, page 7, lines 3-8, Figure 2, for example);
adsorbing the hydrogen sulfide to a nickel oxide catalyst (Specification, page 7, line 9 to page 8, line 15, Figures 2-4, for example); and
flowing varying amounts of a reductant and an oxidant over the nickel oxide catalyst to chemically transform the hydrogen sulfide into at least one other gas-phase sulfur compound, wherein said varying amounts are selected based on exhaust temperature of the catalytic converter, where said selection varies a duration of exposure of said reductant to perform said transforming even as exhaust temperature varies (Specification, page 17, line 1-21, Figure 8, block 616, for example).

Another approach described in the application is set forth in claim 21, which claims:

21. A method of desulfating a catalytic converter, comprising:
adjusting an exhaust air-fuel ratio entering said catalytic converter between rich and lean operation, where durations of said rich and lean operation are adjusted based on catalyst temperature to (Specification, page 17, line 1-21, Figure 8, block 616, for example):
form hydrogen sulfide from sulfur in the catalytic converter (Specification, page 6, line 13 to page 7, line 2, for example);
transport the hydrogen sulfide out of the catalytic converter and into a nickel oxide catalyst downstream of the catalytic converter (Specification, page 7, lines 3-8, Figure 2, for example);
form nickel sulfide from the hydrogen sulfide in the nickel oxide catalyst (Specification, page 7, line 9 to page 8, line 15, Figures 2-4, for example); and
form sulfur dioxide from the nickel sulfide in the nickel oxide catalyst (Specification, page 7, line 9 to page 8, line 15, Figures 2-4, for example).

Still another approach described in the application is set forth in claim 31, which claims:

31. In a mechanical apparatus having a combustion engine, a method of desulfating a catalytic converter, the method comprising:

forming hydrogen sulfide from sulfur in the catalytic converter (Specification, page 6, line 13 to page 7, line 2, for example);

transporting the hydrogen sulfide out of the catalytic converter and into a nickel oxide catalyst downstream of the catalytic converter (Specification, page 7, lines 3-8, Figure 2, for example);

providing a rich air/fuel ratio to the combustion engine for a first interval to increase an amount of a reductant in an exhaust stream from the engine (Specification, Figures 2, 3, 4, page 6, line 20 et seq., for example); and

providing a lean air/fuel ratio to the combustion engine for a second interval to increase an amount of an oxidant in the exhaust stream, wherein durations of said rich and lean air/fuel ratios are adjusted based on exhaust temperature of the converter (Specification, Figures 2, 3, 4, page 6, line 20 et seq., and page 17, line 1-21, Figure 8, block 616, and page 7, line 20 to page 8, line 8 for example).

Further, various additional features are included in dependent claims, which include:

5. The method of claim 3, further comprising reacting the nickel sulfide with an oxidant to form nickel sulfate (Specification, pages 7-8, reaction (2)).

8. The method of claim 5, wherein the nickel sulfide is reacted with the oxidant at a temperature of between approximately 625 and 675 degrees Celsius (Specification, page 9, lines 1-5, and original claim 8, for example)).

10. The method of claim 5, further comprising reacting the nickel sulfate with a reductant to produce sulfur dioxide and to regenerate the nickel oxide (Specification, pages 7-8, reaction (3), for example).

11. The method of claim 10, wherein the reductant is hydrogen gas (Specification, pages 7-8, reaction (3), for example).

13. The method of claim 3, wherein the nickel sulfide is reacted with the oxidant at a temperature of between 350 and 400 degrees Celsius (Specification, page 16, lines 1-8, for example).

19. The method of claim 18, wherein flowing varying amounts of a reductant and an oxidant over the nickel oxide catalyst includes first flowing hydrogen over the catalyst to reduce the hydrogen sulfide to nickel sulfide, then flowing at least one of oxygen and sulfur dioxide over the catalyst to convert the nickel sulfide to nickel sulfate, and then flowing hydrogen over the catalyst to convert the nickel sulfate to nickel oxide and sulfur dioxide (Specification, pages 7-8, reactions (1) to (3), for example).